Insights into three extinct seafloor massive sulphides mounds at TAG, Mid-Atlantic Ridge

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In 2010, the United Nations allowed commercial exploration for seafloor massive sulphides (SMS) in international waters. Although six exploration contracts have been granted for SMS deposits, their economic potential is poorly constrained. It remains unknown what geological processes occur once hydrothermal activity ceases and whether metal tenor becomes enriched, depleted or disappears.

To investigate this, two research expeditions were conducted to the TAG hydrothermal area, 26°N Mid-Atlantic Ridge in 2016 (under the EC-funded project 'Blue Mining', agreement 604500). Three different extinct mounds where studied: Southern, Rona and Mir Zone. These present different ages and stages of alteration and mineralisation. In addition to visual investigations and surface sampling, a robotic seafloor drilling rig (BGS's RD2) was used to obtain cores from deep within the mounds interior, penetrating to ~12mbsf.

First results show all mounds are covered by pelagic sediment beneath which is a thin layer of iron-oxyhydroxides overlaying a hard layer of jasper. Beneath this, pyrite dominates and exhibits either a vuggy texture, with rare colloform sphalerite lining the vug walls, or it is massive with some interstitial layers of chalcopyrite indicative for copper mobilisation and recrystallisation. The texture and composition of the massive sulphide contrasts with fresh chimney material, indicative of post-depositional alteration processes.